Accelerator Design meeting

Monday 05/09/2022, 14:00 – 15:00
(https://indico.cern.ch/event/1195034/)

Chair	Daniel Schulte
Speakers	Roberto Losito, Kyriacos Skoufaris
Participants (Zoom)	Adrian Cross, Akira Yamamoto, Alexej Grudiev, Aman Desai, Andrea Bersani, Anna Kario, Antoine Chancé, Anton Lechner, Bernd Stechauner, Cary Yoshikawa, Chris Rogers, Christian Carli, Claudia Ahdida, Daniel Schulte, Daniele Sertore, Daniele Calzolari, David Amorim, Donatella Lucchesi, Elena Fol, Fabian Batsch, Francisco J. Saura, Fulvio Boattini,Herbert De Gersem, Ivan Karpov, J. Scott Berg, Jose Antonio Ferreira Somoza, Kyriacos Skoufaris, Luca Bottura,Massimo Casarsa, Michele Gallinaro, Nadia Pastrone, Nazar Bartosik, Patricia Tavares Coutinho, Qiang, Roberto Losito, Shahnam Gorgi Zadeh, Yifeng Yang

Meeting Decisions

None.

Meeting Actions

None.

1. News (Daniel Schulte)

- The EU design study proposal has been approved, with high marks! Congratulations and thanks to everyone!
- The grant agreement and the consortium agreement are being finalized (see presentation by **R. Losito**).

- Snowmass (US): there is quite some interest in the muon collider. It is estimated that it would be cheaper than other collider options. Snowmass also gave an overview of what could happen in different regions (US, Europe, Japan, China).

- **L. Bottura** and **C. Carli** are finalizing the collaboration meeting program structure, in collaboration with the Program Committee, taking care of avoiding overlaps in the program. Discussions are ongoing on fee waiving, except for the social dinner.

2. EU design study (Roberto Losito)

Roberto Losito presented an update on the EU design study.

Beneficiaries have to sign the declaration of honor by Sept 6th, and the consortium agreement and grant agreement by 28th of October. The project will start 1st of January 2023, and a kick-off meeting should take place in January or February (options at CERN are being investigated).

The consortium agreement is being prepared by CERN legal service, based on the DESCA model. It will include liability clauses for some associates members of the consortium. An annex will contain the detailed deliverables for each institute. A meeting with work package leaders is foreseen to prepare this annex.

J. Scott Berg asked why a liability clause is included for associate members, which normally don't have deliverables.
C. Rogers precised that UK institutes will get funding from UK agencies, and will have deliverables in the consortium. The liability clause for associate members covers this case specific to UK institutes.

3. Update of the collider design study (K. Skoufaris)

Kyriacos Skoufaris presented an update on the 10 TeV c.o.m collider optics design.

In general, the small β* required will lead to large chromatic effects, that will need to be corrected well beforehand. Muon decay and the induced radiation drive the use of combined function magnets (dipole+quadrupoles or dipole+sextupoles) to avoid straight parts.

A final focusing (FF) scheme with 20 T magnets was presented. If 20T magnets are not available, an option for the final focusing with 16T magnets can be used. The c.o.m energy would need be reduced to 8 TeV or the apertures would need to be reduced.

Beam Induced Background in the final focusing area is significant. Work is ongoing with the FLUKA team to add dipolar components in the FF region to try mitigate it. First FLUKA results (slide 10) don't show a large gain from these additions on the beam induced background, but optimization work is still in progress.

In the FF region, the Montague chromatic functions take large values, leading to large chromatic effects. A chromatic correction region was designed and placed after the FF region to benefit from the large $\beta_{x,y}$ function generated by the FF quadrupoles. It uses dipole-sextupoles combined function magnets. Three doublets of theses magnets are used to control W_x, W_y (Montague functions) and DD_x. There is also a π-phase jump to control the D'_x

The arc design have to compensate the large α_p created by the chromatic correction by generating a negative contribution to α_p. The Flexible Momentum Compaction scheme provides control over the α_p and the chromaticity. The maximum magnetic field assumed is 16T. The matching section between the arc and CC region assumes again a maximum magnetic field of 16T.

The full lattice assembled, first tracking simulation with the linear lattice (all non-linear elements switched off) were presented to check the stable motion. Particles at 1σ and 5σ are tracked. Then simulations with the full non-linear lattice show that there is a large sensitivity to the phase advance errors of the particles.

L. Bottura asked if for straight section and the chromatic correction region it is mandatory to have combined function magnets.
K. Skoufaris precised that the drive for combined function magnets comes from neutrino flux mitigation. This constraint impose a length limit for straights part of ~30 cm.
He also highlighted that the sextupoles don't use the full 16T range.
C. Carli added that it could be interesting to have longer dipoles which would then require lower sextupole components to reduce the neutrino flux by minimizing the straight length.
D. Calzola added that the 2cm clearance assumed in the [5σ+2cm] radius for the magnetic field computation is for the shielding inside the magnet. In the arcs this value could be relaxed.

J. Scott Berg asked what are the technical constraint for combined function magnets dipole-sextupole. **L. Bottura** answered that a sextupole can be created from a modification of the dipole coil shape, but up to a certain strength. After there can be difficult mechanical interactions between the windings.

A. Chancé asked whether the sextupoles are assumed thin or thick for the phase advance sensitivity study, since the thickness could create a phase advance of the order or larger than 10^{-5}.
K. Skoufaris indicated that sextupoles are assumed to be thin for now.

4. AOB (Everybody)

D. Lucchesi reported that the paper for EPJ C is in progress, with already many contributions in it. A deadline in September needs to be set to finalize it.
D. Schulte, C. Rogers and **C. Carli** are editing the document to harmonize it.
D. Schulte emphasized that the target is particle physics community: the paper should guide them to the parts most interesting to them. **C. Rogers** also added that the paper could serve as a reference for our community.

The next meeting will take place on Monday 12th September.

Reported by D. Amorim and D. Schulte